A STUDY ON IMPACT OF COMMODITY FUTURE PRICES ON INFLATION IN INDIA

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Abstract
Commodity markets are experiencing unprecedented growth in India since their re-introduction in 2002. Indian commodity exchanges like Multi Commodity Exchange (MCX) have already established themselves on global front. Gold is one of the dominant commodity traded in India as well as around the globe due to its growing importance as an investment avenue and as a hedge against the recessionary trends.It is experiencing considerable volatility in its prices because of the international markets. The efficiency in price realisations is an essential requirement for any market and the same needs be brought in by building confidence in the minds of the people. In this context the present paper aims to study the efficiency of Gold futures contracts and their impact on inflation. The statistical tests like Augmented Dickey Fuller Test, Phillip-Pherron Test and granger causality test are conducted to evaluate the efficiency of the future markets. The outcomes of the analysis reveal that there is a significant causality relationship between Future and spot markets. For gold which proves that the future markets are efficient and future gold prices not influencing on inflation. The inflation is effecting on future and spot gold prices.

Key words: ADF; Efficiency; Granger Causality Test; Inflation; MCX.

1. Introduction

Commodity markets have grown rapidly in India. The history of commodity futures trading traces 125 years ago. In India commodity futures has been in existence from the 19th century with organised trading in cotton through the establishment of Bombay Cotton Trade Association Ltd in 1875. As many as 110 exchanges were conducting commodity forward trading and seen a booming trend in the country.

The era of shortage in essential commodities, inflation, government interference and other economic factors forced the government to ban the commodity trading. After a gap of 40 years, with efforts made by Prof Kabra Committee report since 1994, the government reintroduced commodity futures trading in agricultural and Bullion commodities in 2002. The Forward Markets Commission (FMC) regulates the trading in commodity derivatives in India.

This led to set up of de-mutualised, technology driven exchanges with nationwide reach adopting the international practices. At present 21 commodity exchanges are in operation in India. Most of these are regional and commodity specific exchanges. During 2003 National Commodity & Derivative Exchange Ltd

(NCDEX), National Multi Commodity Exchanges (NMCE), Multi Commodity Exchange (MCX) and of late Indian Commodity Exchange Ltd (ICE) and Ahmadabad Commodity Exchange (ACE) was established.
The year 2003 was earmarked in the policy framework for commodity market when the Government withdrew all prohibitions and opened forward trading in all commodities. The government also amended Essentials Commodities act, Securities (Contract) Rule for growth in Commodity markets. In January 2007, inflation was rising and Government intervention with political pressure with increase in spot market prices gave rise to inflationary pressures. This led to ban on agricultural commodities. The objective of paper is to test the hypothesis that spot prices depends on future prices thereby resulting in inflation.

1) Statement of the Problem

India is considered as one of the fastest growing economies in the world. Strong domestic demand, large young population, growing levels of literacy and fast expanding trade and commerce are the main contributories for the growth of the country. Like any other developing country, India is also faced with the problem of inflation. Inflation indicates raise in general price levels of goods and services in an economy and reflects erosion in the purchasing power of the money. Inflation is caused by a number factor like variation in demand and supply, supply of money, interest rates, business cycles etc. Though inflation is a common by-product of development, the countries have to measure and manage it at healthy levels.

The importance of commodity exchanges has rapidly grown in the last few years as centres of price discovery and risk management. By providing a mechanism for price discovery for commodities, exchanges are believed to, help the countries in determination of true prices and thereby reduce unwanted volatilities (inflation) in prices of commodities. On the contrary there are others who believe that futures trading in commodities lead to artificial raise in prices of commodities (inflation). The present study is undertaken to study the impact from latter angle. For this purpose Gold futures prices, one of the most prominent commodities traded in India, is chosen. This study assumes more importance as gold also acts as the most sought after asylum against inflation.

2. Review of Literature

There are good number of studies on the *performance and efficiency of Indian commodity derivatives market.* Despite a considerable amount of empirical literature, there is no general consensus on whether or not the markets are efficient. The study by Pantisa Pavabutr and Piyamas Chaihetphon (2010) shows that Gold mini futures contracts at Multi Commodity Exchange of India (MCX) contribute to over 30% if price discovery in gold futures trade even though they account for only 2% of trading value on the MCX. So mini contracts are found to be more informative than what the size of their market share of volume suggests. S. Jackline* and Malabika Deo (2011) in their paper examined the relationship between the futures market and spot market for the lean hogs and pork bellies markets during January 2001 through May 2010 and quantifies the price discovery function of commodity futures prices in relation to spot prices of the sample markets. Results of the econometric tools conclude that the profitable arbitrage does not exist in both of these markets and they are said to be in perfect equilibrium. Gurbandini Kaur and D.N. Rao (2010) in their empirical research on attempted to ascertain the extent to which spot prices impact the prices of futures contracts for Chana, Pepper Malabar, Guar of spot and futures contracts of the chosen commodities and both prices have closely tracked each other in as much as 21 out of 27 contracts. The study further reveals the presence of arbitrage opportunity for pepper and Guar seeds. In an another study Vishwanathan Iyer

and Hardik Mehta (2008) found cash market to be a pure "satellite" of the futures market for two commodities (chana and copper) in the first regime, and for four commodities (chana, copper, gold and rubber) in the second regime. Gold and silver, as expected, showed the highest convergence between the spot and futures while nickel, rubber and chana showed very poor convergence between the markets.

A significant number of studies, both theoretical and empirical, have examined the efficiency of futures trading in commodities in well developed markets like US, Europe and Asia. The prices in these markets are more or less in agreement with or at least lean towards what should be expected in a mature or efficient market. Garbade and Silber (1983) tested seven commodities, viz., Copper, Gold, Silver, Wheat, Corn, Oats and Frozen orange juices, for efficiency in risk management and price discovery. In their research they argue that futures contracts will not in general, provide perfect risk transfer facilities over short-run horizons; though over the long run cash and futures prices should be integrated. But gold and silver on the contrary were highly integrated even over one day.

Empirical research by Dimitris F. Kenorgios (2004) once again upheld that copper futures markets on the London Metal Exchange are inefficient and the three and fifteen months of futures prices do not provide unbiased estimates of the future spot prices in both the long-run and short-run.

There are a very few studies on the *impact of commodities futures on inflation.* A study by Arena Parkas and Thejaswani Koila (2007) reveals reasons for ban of rice and wheat futures in India in 2007 and its impact on inflation. The results show that commodity futures do not effect inflation. Another study by Amij Kumar Kedia and Varun Bakshi (2007) on commodity futures and inflation with backwardation and contango taking wholesale price index and conclude inflation does not depend on commodity futures trading. A.J.hughes and Hallet talks about conventional buffer stock interventions stabilising prices significantly and its cost effect due to the inelasticity of Supply and Demand. Similarly Jere R.Behrman analyses commodity price instability and economic goal attainment in developing countries. He tells commodity price fluctuations might have substantial impact on developing country products because of nonlinearities and high storage costs.

3. Objectives

- *To check the efficiency in commodity futures for Gold resulting in inflation*

  To achieve the above objective following hypothesis are drawn

H1= Future prices cause spot prices for Gold

H2= Future prices cause inflation.

4. Study Design and Methods

The present study is an analytical study based on secondary data. Secondary data consisting of daily spot and nearest month future prices were taken from MCX website for gold with delivery centre at Ahmedabad and the WPI data was taken from the database of an Indian economy. The study covers a period of 2 years starting from 1st January 2010 till 31st December 2011.

The present study makes use of time series data and the essential requirement of data series analysis is the data series is stationary (does not have a unit root). Stationarity is tested statistically using Augmented Dickey-Fuller Test and Phillip-Perron (PP) test. The lag structure to be used was identified based on Akaike

Information Criterion. Further Granger Causality test is conducted to study the causality relationship between the future and spot prices of gold contracts. Later on the causality test was repeated between the Inflation (WPI Index) and future prices of gold. The test may also conclude the existence of bi-directional causality relationship between the variables. Based on the results of the Granger causality test the conclusions will be made on the efficiency of futures trading in India with reference to gold contracts and its effect on inflation.

4.1 Augmented Dickey Fuller Test

For the best results the data series used in time series analysis should be stationary. Non-stationarity, also called as presence of unit root, causes problems in statistical inferences if it is not adequately dealt with. There are 3 important tests available for testing presence of unit root in the data series. They are Dickey Fuller (DF), Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) Test. Out of these ADF developed by D.A. Dickey and W.A. Fuller is the most frequently used by researchers and the same has been applied in our research. Technically ADF includes DF and can be applied for a larger and more complicated set of time series sample. The test consists of estimating the following regression.

$$\Delta R_t = \beta_1 + \beta_2 t + \rho R_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta R_{t-1} + u_t \qquad (1)$$

Where, ΔR is the first difference of Rt, β_1 is the intercept, β_2, ρ are the coefficients, t is the time or trend variable, m is the number of lagged terms chosen to ensure that u_t is white noise, i.e. u_t contains no autocorrelation and is the pure white noise error term , and

$\sum_{i=1}^{m} \alpha_i \Delta R_{t-1}$ is the sum of the lagged values of the dependent variable ΔR.

4.1.1 Granger Causality

This study examines the lead-lag relationship between futures trading activity and cash price volatility using Granger Causality (1969) test. The dynamic linkage between the futures prices series and the spot prices series is given by the Pair-wise Granger Causality tests (Granger, 1986). Testing the causality between two stationary series X_t and Y_t are based on the following equations:

$$X_t = \alpha_0 + \sum_{i=1}^{m} y_i \; x_{t-i} + \sum_{j=1}^{m} \beta_i \; y_{t-j} + u_{1t} \qquad (2)$$

$$Y_t = \alpha_0 + \sum_{i=1}^{m} y_i \; x_{t-i} + \sum_{j=1}^{m} \beta_i \; y_{t-j} + u_{2t} \qquad (3)$$

Where m is a suitably chosen positive integer, γj and βj, j = 0, 1,.....k parameters, α is a constant and u_t is disturbance term with zero means and finite variance. The proposition that Y_t does not granger-cause X_t is not accepted if βj s,j > 0 as in Equation 2, are jointly different from zero using a standard joint test. Similarly, Xt Granger causes Yt, if γj are j>0, coefficients in Equation 3 are jointly different from zero. The causal relationship between the spot and future prices for Gold is presented below. Here two regression analyses are done, *firstly* from spot prices to future prices and *secondly* from future prices to spot prices. In the present study the Granger causality test involves estimating the following pairs of regressions.

$Lspot_t = \sum_{i=1}^{m} \alpha_i \ LGspot_{t-i} + \sum_{j=1}^{m} \beta_i \ LGfuture_{t-j} + u_{1t}$

$Lfuture_t = \sum_{i=1}^{m} \delta_i \ LGfuture_{t-i} + \sum_{j=1}^{m} \delta_i \ LGclose_{t-j} + u_{2t}$

Similarly causal relationship between Futures prices and WPI indices are done. *Firstly* from futures prices to WPI indices and, *secondly* from WPI Indices to Futures prices.

5. *Data Analysis and Discussions*

Results of Augmented Dickey Fuller test and Phillip Pherron tests are done to check the stationarity of the data series. The absolute values of ADF and PP test statistic are more than the critical value at 5% level (Refer Table 1 in Appendix). Therefore, the first differenced log of data series can be taken to be stationary. The hypothesis that near month futures prices and spot close prices having unit root can be rejected.

5.1 *Testing for Causality*

5.1.1. Causality between Futures Prices of Spot and Futures prices of Gold

The reported F-statistic value and the probability value suggest that there is single-directional causality flowing from futures to spot prices of gold. In other words, results indicate future prices of gold have impact on spot prices and not the vice versa. So like majority of studies, the test results indicate that future prices influence spot prices but not vice versa. The rationalization of the result is that future prices respond to new information more quickly than spot prices, due to lower transaction costs and flexibility of short selling (Cees G.H Diks and Stelios D. Bekiros).

Table 1: Causality between spot and futures prices of Gold

Pairwise Granger Causality Tests				
Null Hypothesis:	Obs	F-Statistic	Probability	Decision
LGSPOT does not Granger Cause LFUTURE	624	0.29511	0.74455	Do not Reject
LGFUTURE does not Granger Cause LSPOT		262.261	0.00000	Reject

Moreover, hedgers with storage constraints will buy future contracts. Therefore, both hedgers and speculators will react to the new information by preferring futures rather than spot transactions. So we accept the hypothesis that future prices cause spot prices for gold. The long-term relationship between the futures and spot prices of gold was re-confirmed by running Johansen's co-integration (Refer Table 3 in appendix). The Trace statistic and maximum Eigen value statistic indicated the existence of one co-integration equation between the futures and spot gold price

6.1.2. Causality between Futures Prices of Gold and WPI

The test indicates that WPI index causes spot and future prices. This shows that spot and future prices are not causing inflation. Therefore, we reject the hypothesis. The inflation is effecting/influencing on future prices and the future prices is influencing on spot price of gold. Because there is a relationship between future and spot prices because of this inflation is effecting on spot price of gold.

Table 2 : Causality between Futures prices of Gold and Inflation (WPI Index)

Pair-wise Granger Causality Tests on Gold Futures, Spot prices and WPI Index Sample: 1 624 Lags: 2			
Hypothesis	F-Statistic	Probability	Decision
WPI Index does not Granger cause futures	6.02845	0.00216	Reject
Future does not Granger cause WPI index	1.42407	0.11046	Do not Reject
WPI index does not granger cause spot	8.22015	0.00030	Reject
Spot does not Granger cause WPI index	1.60301	0.1720	Do not Reject

6. Conclusion

The present study aims to impact of Commodity futures prices in Indian context. For this purpose daily spot and futures prices of near monthly contracts of Gold futures contracts traded at MCX India, for last two years are considered with WPI indices (weekly). In order to obtain credible results for any conventional regression analysis, the data to be analyzed should be stationary. To examine whether the data series are stationary or not Augmented Dickey Fuller (ADF) test has been performed for all the data series. The results of ADF test on Gold prices negate the existence of unit root in the spot and future price series at 5% significance level. Therefore, spot and future returns follow a stationary process. Besides test results show that the data series of future and spot prices of Gold is stationary in first order level itself.

To study the causality relationship, two regression analyses are done, firstly from spot prices to future prices and secondly from future prices to spot prices. The lag length of the price selected is two. This is identified based on Akaike Information Criterion (AIC). Causality test reveals that there is a noticeable and statistically significant causality from future prices to spot prices during years under review. So we accept the hypothesis and conclude that market future contracts for gold are efficient and respond to the new information quickly. Similarly the results of pair-wise granger pair-wise granger causality of Futures and spot prices of gold with inflation (WPI Index) supports rejection of hypothesis and confirms that future prices does not cause Inflation. Other commodities and other macro economic factors can be tested for causing inflation.

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APPENDIX

Table 1 : ADF and PP test for Stationarity

Unit Root Test	Ln Future Price		First Differenced Ln of future Prices		Ln Spot Price		First Differenced Ln of Spot Price	
Critical Value	ADF Test Statistic	PP Test Statistic	ADF Test Statistic	PP Test Statistic	ADF Test Statistic	PP Test Statistic	ADF Test Statistic	PP Test Statistic
Calculated	-0.19871	0.290981	-27.0165*	-27.0510*	-0.211315	-0.296002	-25.66173*	-25.7928*
5% Level	-2.865	-2.865	-2.865	-2.865	-2.865	-2.865	-2.865	-2.865
P Value	0.9359	0.9235	0.0000*	0.0000*	0.9344	0.9228	0.0000*	0.0000*
Result	Non-Stationary		Stationary		Non-Stationary		Stationary	

*Significant at 5% level

Table 2 : RESULTS OF GRANGER CAUSALITY TEST

Pairwise Granger Causality Tests
Sample: 1 626
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability	Decision
LGSPOT does not Granger Cause LFUTURE	625	3.49733	0.06194	Do not Reject
LGFUTURE does not Granger Cause LSPOT		465.399	0.00000	Reject

Pairwise Granger Causality Tests
Sample: 1 626
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability	Decision
LGSPOT does not Granger Cause LFUTURE	624	0.29511	0.74455	Do not Reject
LGFUTURE does not Granger Cause LSPOT		262.261	0.00000	Reject

Pairwise Granger Causality Tests
Sample: 1 626
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability	Decision
FDLGSPOT does not Granger Cause FDLFUTURE	624	0.18165	0.67011	Do not Reject
FDLGFUTURE does not Granger Cause FDLSPOT		340.695	0.00000	Reject

Pairwise Granger Causality Tests
Sample: 1 626
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability	Decision
FDLGSPOT does not Granger Cause FDLFUTURE	623	1.48773	0.22669	Do not Reject
FDLGFUTURE does not Granger Cause FDLSPOT		243.470	0.00000	Reject

Table 3 : Results of Johansen co-integration test for futures and spot prices

Trace Test Results			
Hypothesized		Trace	0.05
No. of CE(s)	Eigenvalue	Statistic	Critical Value
None *	0.129135	86.18870	15.49471
At most 1	7.67E-05	0.047784	3.841466
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values			
Rank Test (Maximum Eigenvalue)			
Hypothesized		Max-Eigen	0.05
No. of CE(s)	Eigenvalue	Statistic	Critical Value
None *	0.129135	86.14091	14.26460
At most 1	7.67E-05	0.047784	3.841466
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values			